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**Contents: Calibration**

 Effective Date: **May 2003**

 Point of Contact: [Quality Programs & Services Office](#)


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## Training Requirements and Reporting Obligations

This subject area does not contain training requirements.

This subject area does not contain reporting obligations.

## References

BNL's [Requisition System](#)

[Evaluation of Seller Quality Assurance \(QA\) Programs](#) Subject Area

[Graded Approach for Quality Requirements](#) Subject Area

[Integrated Assessment](#) Subject Area

[ISO 14001 "Plus" Environmental Management System Manual](#) Program Description

[List of Calibration Laboratories Approved by QPSO, Quality Programs & Services Office](#) Web site

[National Institute of Standards and Technology](#)

[Nonconformance and Corrective and Preventive Action](#) Subject Area

[Purchase Requisition Review for Quality-related Requirements](#) Subject Area

[Work Planning and Control for Experiments and Operations](#) Subject Area

## Standards of Performance

All scientific and professional staff shall identify and control items and material affecting scientific results.

All staff shall maintain records necessary to substantiate results and processes of research, operational, or administrative activities; protect records from loss or damage; refer requests from non-BNL staff through proper channels; and retire records to approved record storage areas.

## Management System

This subject area belongs to the **Quality Management** management system.

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**Introduction: Calibration**Effective Date: **May 2003**Point of Contact: [Quality Programs & Services Office](#)

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This subject area addresses the identification of equipment to be calibrated and related calibration requirements. Calibrated equipment aids in ensuring the accuracy of the data being recorded and the judgments made based on this data.

By applying the graded approach, the most emphasis is placed on those items that may have the greatest effect upon personnel, environment, safety, health, cost, data quality, equipment, performance, and schedule. See the [Graded Approach for Quality Requirements](#) Subject Area for information on the graded approach.

Calibration may also be required by the contract, client/sponsor, or management.

Refer to the [Calibration Flowchart](#) for an overview of the procedures described in this subject area.

This subject area does not apply to unique research apparatus/equipment intrinsic to the experiment, which is set up and calibrated by researchers using procedures or processes accepted by the appropriate scientific community. Other equipment used in support of scientific research must be reviewed using this subject area.

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Subject Area: **Calibration**

## 1. Determining if Calibration is Required

Effective Date: **May 2003**

Point of Contact: [Quality Programs & Services Office](#)

## Applicability

This information applies to staff who consider and identify equipment for calibration.

## Required Procedure

Unique research apparatus/equipment intrinsic to the experiment, which is set up and calibrated by researchers, may be addressed through procedures or processes accepted by the appropriate scientific community. Other equipment used in support of scientific research must be reviewed using this section. **Note:** For examples of other equipment used in support of scientific research, refer to the exhibit [Recommended Calibration Intervals](#). This exhibit does not contain an all-inclusive listing.

Calibration may also be required by the contract, client/sponsor, or management.

The Line Manager, Principal Investigator, or designee completes the following steps.

<b>Step 1</b>	<p>Equipment used in the following activities must be considered for calibration:</p> <ul style="list-style-type: none"> <li>• Inspections;</li> <li>• Acceptance testing;</li> <li>• Data collection;</li> <li>• Process monitoring;</li> <li>• Maintenance, repair, and calibration of installed facility equipment and instruments.</li> </ul> <p>When a system/item classified as A1 - Critical or A2 - Major is not calibrated, the responsible individual must obtain appropriate approval from the Line Manager or Designee, and maintain documentation, e.g., work planning and control documentation. The decision to calibrate a system/item classified as A3 - Minor or A4 - Negligible is at the discretion of the responsible individual, as is the documentation of a decision not to calibrate.</p> <p>In deciding to calibrate equipment identified in the above list of activities, consider the following:</p> <ol style="list-style-type: none"> <li>1. If equipment performance can affect the product or quality of results in ways not detectable with other calibrated instruments and procedures.</li> <li>2. If data produced by the equipment is compromised, not retrievable or not repeatable, project and/or operations costs are raised unacceptably.</li> <li>3. The level of designed redundancy in the monitoring/testing performed, e.g., amount of make up water measured with two different flow meters.</li> </ol>
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- make-up water measured with two different flow meters.
4. All the different equipment/processes/protocols used to perform or derive monitoring/testing results within the system, i.e., same measurement made using different equipment/process/protocol. For example, monitoring of the level in a tank performed by both mechanical and electronic gauges.

**Note:** For more information on ESH&Q Risk Levels (Graded Approach), refer to the exhibit [Screening Guidelines for Work Planning & Control and Application of the Quality Graded Approach](#) in the [Work Planning and Control for Experiments and Operations](#) Subject Area.

## References

[Work Planning and Control for Experiments and Operations](#) Subject Area

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Subject Area: **Calibration**

## 2. Calibrating Equipment

Effective Date: **May 2003**

Point of Contact: [Quality Programs & Services Office](#)

## Applicability

This information applies to staff who consider and identify equipment for calibration.

## Required Procedure

Calibrating Equipment contains three subsections:

- [2.1 Equipment Calibrated by an Off-site Supplier](#)
- [2.2 Equipment Calibrated by a BNL Organization](#)
- [2.3 Equipment Calibrated within your Organization](#)

## 2.1 Equipment Calibrated by an Off-site Supplier

Staff members who arrange for calibrations conducted by an off-site supplier complete the following steps.

<b>Step 1</b>	<p>Locate a calibration service provider that is capable of calibrating your equipment. Acceptable calibration service providers include the original equipment manufacturer (OEM) or their calibration agency, and qualified suppliers. Suppliers must have undergone an acceptable seller evaluation within the last 3 years and demonstrate compliance to one or more of the following standards:</p> <ul style="list-style-type: none"> <li>ANSI/NCSL Z540-1-1994, "Calibration Laboratories and Measuring and Test Equipment - General Requirements."</li> <li>ISO Guide 25, "General Requirements for the Competency of Calibration and Testing Laboratories."</li> <li>ISO/IEC 17025, "General Requirements for the Competency of Calibration and Testing Laboratories." <b>Note:</b> ISO/IEC 17025 has replaced ISO Guide 25. However, some service providers are still following ISO Guide 25.</li> <li>ISO 9001 (Quality systems - <i>Model for quality assurance in design, development, production, installation and servicing</i>).</li> </ul> <p><b>Note:</b> Copies of the above standards are available from the <a href="#">Quality Programs and Services Office</a>.</p> <p>Refer to the <a href="#">List of Calibration Laboratories Approved by QPSO</a>, maintained by Quality Programs and Services Office, that can be used to calibrate equipment. For assistance with determining if other suppliers not listed have undergone an acceptable seller evaluation (within the last 3 years).</p>
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	<p>contact the <a href="#">Quality Programs and Services Office</a>. For more information on seller evaluations, see the <a href="#">Evaluation of Seller Quality Assurance (QA) Programs</a> Subject Area.</p> <p>Equipment sent for calibration to the OEM's or manufacturer's calibration agency does not need an evaluation.</p>
<b>Step 2</b>	<p>Initiate a requisition (on BNL's <a href="#">Requisition System</a>) for calibration services and specify the following:</p> <ul style="list-style-type: none"> <li>• Type: <i>Purchased Services</i>;</li> <li>• Requisition description: <i>Calibration of Equipment/Instrumentation (the instrument's manufacturer, model name or number, serial number, and unique identification number, if applicable) and any applicable calibration requirements listed in Step 1</i>;</li> <li>• Product categorization: <i>Testing Services or Repair</i>;</li> <li>• QA Category: Critical (A1), Major (A2), Minor (A3), or Negligible (A4);</li> <li>• Seller Quality Assurance Requirements (BNL-QA-101), the following paragraphs: <ul style="list-style-type: none"> <li>○ 3.1.3 for calibration provided by the Original Equipment Manufacturer (OEM)</li> <li>○ 3.1.1, 3.1.2 or 3.1.4, as appropriate.</li> <li>○ 4.33.</li> </ul> </li> </ul> <p><b>Note:</b> For more information about using the <a href="#">Seller Quality Assurance Requirements (BNL-QA-101)</a>, see the <a href="#">Purchase Requisition Review for Quality-related Requirements</a> Subject Area. Assistance with the Seller Quality Assurance Requirements (BNL-QA-101) can be obtained from your <a href="#">Quality Representative</a> or the <a href="#">Quality Programs &amp; Services Office</a>.</p> <p><b>Note:</b> For the calibration of balances/weights and micropipettes, a BNL standardized scope of work was developed. See the exhibit <a href="#">BNL Statement of Work for Calibration of Balances and Micropipettes</a>. A purchase requisition for this service must be issued with this scope of work. The scope of work can be modified to identify specific individuals for the referenced Technical Representative or Designated Person. In addition, provide a list of equipment to be serviced: use the <a href="#">Balance-Micropipette Information Form</a>.</p>
<b>Step 3</b>	<p>Send (or arrange for pick up) measuring devices calibrated by an off-site service to the appropriate calibration service provider. Ensure that they are packaged appropriately.</p> <p>Measuring devices calibrated onsite are to be located where they can be easily found by the calibration service provider when scheduled for calibration.</p>
<b>Step 4</b>	<p>Upon receipt of calibrated equipment from the calibration supplier, check</p> <ul style="list-style-type: none"> <li>• If the documentation supplied indicates that the equipment was received (by the supplier) in an out-of-tolerance condition, or if calibrated items did not meet the technical specifications;</li> <li>• That the calibration sticker is attached; and</li> <li>• That the old calibration stickers have been removed, if necessary.</li> </ul>
<b>Step 5</b>	<p>If the calibration documentation indicates that the item was out-of-tolerance or the equipment does not meet the technical specifications, the responsible staff member initiates an investigation according to the <a href="#">Nonconformance and Corrective and Preventive Action</a> Subject Area.</p> <p>Consider the following when conducting an investigation:</p> <ul style="list-style-type: none"> <li>• Where the equipment was used;</li> <li>• The out-of-tolerance condition;</li> <li>• If measurements performed with the equipment need to be repeated; and</li> <li>• Actions to be taken regarding the calibrated equipment (e.g., shorten calibration interval, retire equipment).</li> </ul>

	<b>Note:</b> Assistance with the nonconformance report can be obtained from your <a href="#">Quality Representative</a> or the <a href="#">Quality Programs &amp; Services Office</a> .
<b>Step 6</b>	Update all appropriate records (for example, the <a href="#">Calibrated Equipment Information Form</a> and the <a href="#">Calibration Data Form</a> ).

## 2.2 Equipment Calibrated by a BNL Organization

Staff members who arrange for calibrations conducted by another BNL organization complete the following steps.

<b>Step 1</b>	<p>Requisition the service of the BNL organization providing the calibration (e.g., the ES&amp;H Instrument &amp; Calibration [I&amp;C] Group, or Central Shops).</p> <p><b>Note:</b> The BNL organization calibrating the equipment proceeds according to Steps 1 - 3 in the subsection Equipment Calibrated within your Organization.</p>
<b>Step 2</b>	<p>Send the equipment to (or arrange for pickup by) the BNL organization providing the calibration service. Ensure that it is packaged appropriately.</p> <p>Equipment calibrated in place is to be located where the calibration service provider can easily find it when scheduled for calibration.</p>
<b>Step 3</b>	<p>Upon the completion of calibration service, check</p> <ul style="list-style-type: none"> <li>• If documentation supplied indicates that the equipment was received (by the supplier) in an out-of-tolerance condition, or if calibrated items did not meet the technical specifications;</li> <li>• That the calibration sticker is attached; and</li> <li>• That the old calibration stickers have been removed, if necessary.</li> </ul>
<b>Step 4</b>	<p>If the calibration documentation indicates that the item was out-of-tolerance or the equipment does not meet the technical specifications, the responsible staff member must initiate an investigation according to the <a href="#">Nonconformance and Corrective and Preventive Action</a> Subject Area. Consider the following when conducting an investigation:</p> <ul style="list-style-type: none"> <li>• Where the equipment was used;</li> <li>• The out-of-tolerance condition;</li> <li>• If measurements performed with the equipment need to be repeated; and</li> <li>• Actions to be taken regarding the equipment (e.g., shorten calibration interval, retire equipment).</li> </ul> <p><b>Note:</b> Assistance with the nonconformance report can be obtained from your <a href="#">Quality Representative</a> or the <a href="#">Quality Programs &amp; Services Office</a>.</p>
<b>Step 5</b>	Update all appropriate records (for example, the <a href="#">Calibrated Equipment Information Form</a> and the <a href="#">Calibration Data Form</a> ).

## 2.3 Equipment Calibrated within your Organization

The staff member calibrating equipment completes the following steps.

<b>Step 1</b>	<p>Calibrate equipment in accordance with a written calibration procedure, which as a minimum, includes the following information:</p> <ul style="list-style-type: none"> <li>• Identity of the item to be calibrated;</li> </ul>
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	<ul style="list-style-type: none"> <li>• Identity of the item to be calibrated;</li> <li>• Calibration equipment and reference standards to be used;</li> <li>• Checks, tests, measurements, and acceptance tolerances;</li> <li>• Sequence of operations used to perform the calibration; and</li> <li>• Special instructions for calibration as necessary.</li> </ul> <p>Manufacturers' instructions, published standard practices, or other written instructions are acceptable if they contain the above information.</p> <p><b>Note:</b> Ensure that environmental conditions are suitable for the calibration, inspections, measurements, and tests being performed. Consider evaluating calibration uncertainty as part of the calibration process.</p>
<b>Step 2</b>	<p>Document the calibration using the <a href="#">Calibration Data Form</a> or a project-specific form from your department/division that includes the following essential elements:</p> <ul style="list-style-type: none"> <li>• Description;</li> <li>• Manufacturer, Model Number, Serial Number, or Unique Identification Number;</li> <li>• Calibration procedure;</li> <li>• Calibration frequency;</li> <li>• Environmental conditions;</li> <li>• Comments;</li> <li>• Standards and calibration equipment used (i.e., Description, Identification Number, and Calibration Due Date);</li> <li>• Calibration data (i.e., Step, Function Tested, Expected Plus/Minus Tolerance, and Before and After Data); and</li> <li>• Performed by date and status (i.e., Accepted, Rejected, and Limitations).</li> </ul> <p><b>Note:</b> At the discretion of the cognizant manager, equipment calibrated before it is used can be documented in laboratory notebooks with the appropriate information from the above list.</p>
<b>Step 3</b>	<p>Label the equipment with the following information:</p> <ul style="list-style-type: none"> <li>• Equipment Identification Information, e.g., Model Number, Serial Number or Unique Identification Number;</li> <li>• Identity of the person who performed the calibration; and</li> <li>• Due date of the next calibration.</li> </ul> <p>See the Guidelines for recommended labels to use.</p> <p><b>Note:</b> At the discretion of the cognizant manager, equipment calibrated before it is used can be labeled, or the calibration recorded in laboratory notebooks. If the item is too small, a label can be affixed to its container.</p>
<b>Step 4</b>	<p>If the calibration documentation indicates the item was out-of-tolerance or the equipment does not meet the technical specifications, the responsible staff member initiates an investigation according to the <a href="#">Nonconformance and Corrective and Preventive Action</a> Subject Area. Consider the following when conducting an investigation:</p> <ul style="list-style-type: none"> <li>• Where the equipment was used;</li> <li>• The out-of-tolerance condition;</li> <li>• If measurements performed with the equipment need to be repeated; and</li> <li>• Actions to be taken regarding the equipment (e.g., shorten calibration interval, retire equipment).</li> </ul> <p><b>Note:</b> Assistance with the nonconformance report can be obtained from your <a href="#">Quality Representative</a> or the <a href="#">Quality Programs &amp; Services Office</a>.</p>
<b>Step 5</b>	<p>Update all appropriate records (for example, the <a href="#">Calibrated Information Form</a> and the <a href="#">Calibration Data Form</a>).</p>

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## Guidelines

### Environmental Factors

Calibrated equipment and reference standards should be calibrated in environments that will not adversely affect their accuracy. The following environmental factors should be considered:

- Temperature;
- Humidity;
- Vibration;
- Radio frequency interference;
- Electromagnetic interference;
- Background radiation;
- Dust;
- Cleanliness; and
- Fumes.

The factors listed above should also be considered when calibrated equipment is being transported and stored.

### Labeling

Calibration labels are available from BNL stock. See the exhibit [Quality Control Self-Adhesive Labels](#) for descriptions and stock numbers of labels. In addition, BNL stocks other tags useful in identifying various nonconforming items. See the exhibit [Quality Control Tags](#).

Equipment that is not included in the calibration program should be labeled accordingly (i.e., "Not Calibrated" or "For Reference Use Only"), at the discretion of the cognizant manager. Equipment removed from the calibration program should have the calibration labels removed.

### Standards

Equipment should be calibrated using calibrated standards that have a known valid relationship, traceable to a recognized national or international standard, such as the [National Institute of Standards and Technology](#) (NIST). If no such standard exists, the basis for calibration should be documented.

Standards, when feasible, should have an accuracy at least four times better than the item of equipment being calibrated, and preferably ten times better than the item being calibrated.

Standards should have a documented traceability to a recognized national or international standard by one of the following means:

- Supplied data and reports that indicate the standards used and their reference to a recognized national or international standard;
- Certifications that indicate that the standards used can be traced to a recognized national or international standard.

### Calibration Intervals

Calibration intervals should be established based on manufacturer's recommendations, equipment usage, and prior calibration history. For further information, refer to the [Optimizing Calibration Intervals](#) and the [Recommended Calibration Intervals](#) exhibits. Temporary extensions of the calibration interval should be documented, identifying the specific reasons for the extension. Extensions should be maintained with the equipment history.

### Retiring Calibrated Equipment

Retired calibrated equipment should undergo a final calibration, if possible, when it is removed from the program. The date the item is removed should be noted on appropriate records, such as the [Calibrated Equipment Information Form](#) and the [Calibration Data Form](#).

## Reviewing Calibration Records

The overall calibration process and the equipment calibration data should be periodically reviewed.

Review and analysis of the data would identify trends that may adversely impact measurements. Based on this review, questionable equipment may be retired or new equipment added, intervals of calibration could be adjusted, and procedures corrected. Refer to the [Calibrating Equipment](#) section.

Review of the overall calibration process could be performed as part of the organization's self-assessments (refer to the [Integrated Assessment](#) Subject Area). This review could identify opportunities for improvement with other elements of the calibration program.

## Equipment History Record File

The Equipment History Record Files may also contain

- Maintenance records;
- Copies of nonconformance reports involving calibrated equipment;
- Calibration data and certificates.

## References

BNL's [Requisition System](#)

[Evaluation of Seller Quality Assurance \(QA\) Programs](#) Subject Area

[Integrated Assessment](#) Subject Area

[List of Calibration Laboratories Approved by QPSO, Quality Programs & Services Office](#) Web site

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Subject Area: **Calibration**

### 3. Scheduling Equipment for Recalibration

Effective Date: **May 2003**

Point of Contact: [Quality Programs & Services Office](#)

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## Applicability

This information applies to staff or users who coordinate the recalibration of equipment.

## Required Procedure

The staff member or user completes the following steps when planning for the recalibration of equipment.

<b>Step 1</b>	Identify equipment due for calibration before the due date. If necessary, notify remote users of the device.  <b>Note:</b> All equipment should be scheduled for recalibration within two to four weeks of the due date.  <b>Note:</b> Planning for the recalibration can done by reviewing equipment records (i.e., the <a href="#">Calibration Data Form</a> and the <a href="#">Calibrated Equipment Information Form</a> ) to identify when equipment is due for calibration and to determine its location.
<b>Step 2</b>	Send equipment calibrated by an off-site service to the appropriate calibration service provider (or arrange for pick up). Identify equipment calibrated onsite to ensure that it can be located by the calibration service provider. Refer to the <a href="#">Calibrating Equipment</a> section for information.
<b>Step 3</b>	Perform appropriate follow-up on equipment due for calibration that has not been found, i.e, equipment that may be lost or misplaced.

## Guidelines

### Transporting Equipment

Calibrated equipment should be transported and stored in an environment that will not adversely affect its accuracy.

### Equipment Control

Equipment that is returned for calibration should be kept in a segregated area to prevent its inadvertent use before calibration.

## Tracking Calibrated Equipment

Calibrated equipment should be tracked to ensure that it is calibrated on time. Tracking can be done by monitoring the calibration due dates. A database can be developed to assist in this tracking, or commercially developed software can be used. Contact the [Quality Program Office](#) for more information. This information can also be tracked manually using the following forms and equipment records. If temporary extensions of the calibration interval are allowed, specific reasons for the extension should be documented and maintained with equipment history.

- [Calibration Data Form](#) - used to record data during calibration;
- [Calibrated Equipment Information Form](#) - maintains specific information for calibrated equipment.

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# BNL Statement of Work for Calibration of Balances and Micropipettes

Rev. 3

11/08/02

Service Provided: Calibration of Balances and Micropipettes

Note: This Scope of Work can also be used for calibration of weight sets.

Duration of Contract: For the period *<enter start date>* through *<end date>*, for *<enter department/division name>* at Brookhaven National Laboratory (BNL) in accordance with this scope of work.

Description of Service: The Contractor shall furnish the services of its trained personnel and provide the necessary equipment and supplies to perform routine and non-routine calibration and preventive maintenance on the balances/micropipettes. Emergency service will be provided within forty-eight (48) hours. Service required is to replace required parts when necessary, disassemble, clean and lubricate, recalibrate, reassemble and adjust to manufacturer's specifications, and make adjustments.

Balances/micropipettes to be maintained are located in various buildings on the BNL site at Upton, NY. BNL will furnish the Contractor with a detailed list of balances/micropipettes and a service schedule. The Contractor shall service each balance/micropipette on this list at least once a year in accordance with the schedule. The procedure(s) used to calibrate the balances/micropipettes must be approved by BNL's Office of Quality Programs and Services. The Contractor will unconditionally guarantee balances from malfunctions resulting from improper service for a period of one (1) year and micropipettes for ninety (90) days. If more than routine service is required, the Contractor will notify the Technical Representative or designated point of contact for authorization before proceeding. Separate provisions will be made for additional service required as a result of accidental damage. If the balance/micropipette must be taken offsite for service, the Contractor will provide a receipt for the item(s) and shall return the item(s) within ten working days, unless otherwise approved by the Technical Representative or designated point of contact.

At least one month before the calibration due date, the Contractor will call *<enter name>*, the Building Manager, or the designated point of contact on the list provided by BNL and make an appointment. The designated point of contact or Technical Representative will provide the Contractor with an updated list of all balances/micropipettes to be serviced and their location. The updated list will show any new balances/micropipettes and eliminate any balance/micropipettes taken out of service. All service must be completed on or before the due date, unless an extension is granted by the Technical Representative or designated point of contact. The Contractor will bring to the attention of the Technical Representative or designated point of contact any balances/micropipettes not found and therefore not serviced.

Applicable Requirements: The Contractor must meet the requirements of ANSI/NCSL Z540-1-1994, "Calibration Laboratories and Measuring and Test Equipment - General Requirements." BNL reserves the right to evaluate the Contractor to determine conformance to this standard.

Training: Contractor's personnel will be required to take and pass, where required, training courses provided by BNL. The appropriate BNL Department/Division Work Control Coordinator will determine the required training.

**Calibration Certificate:** The Contractor shall submit with each balance/micropipette a certification form, approved by BNL's Office of Quality Programs and Services, that the balance/micropipette has been calibrated and is ready for use. The certification form shall contain as a minimum the following items:

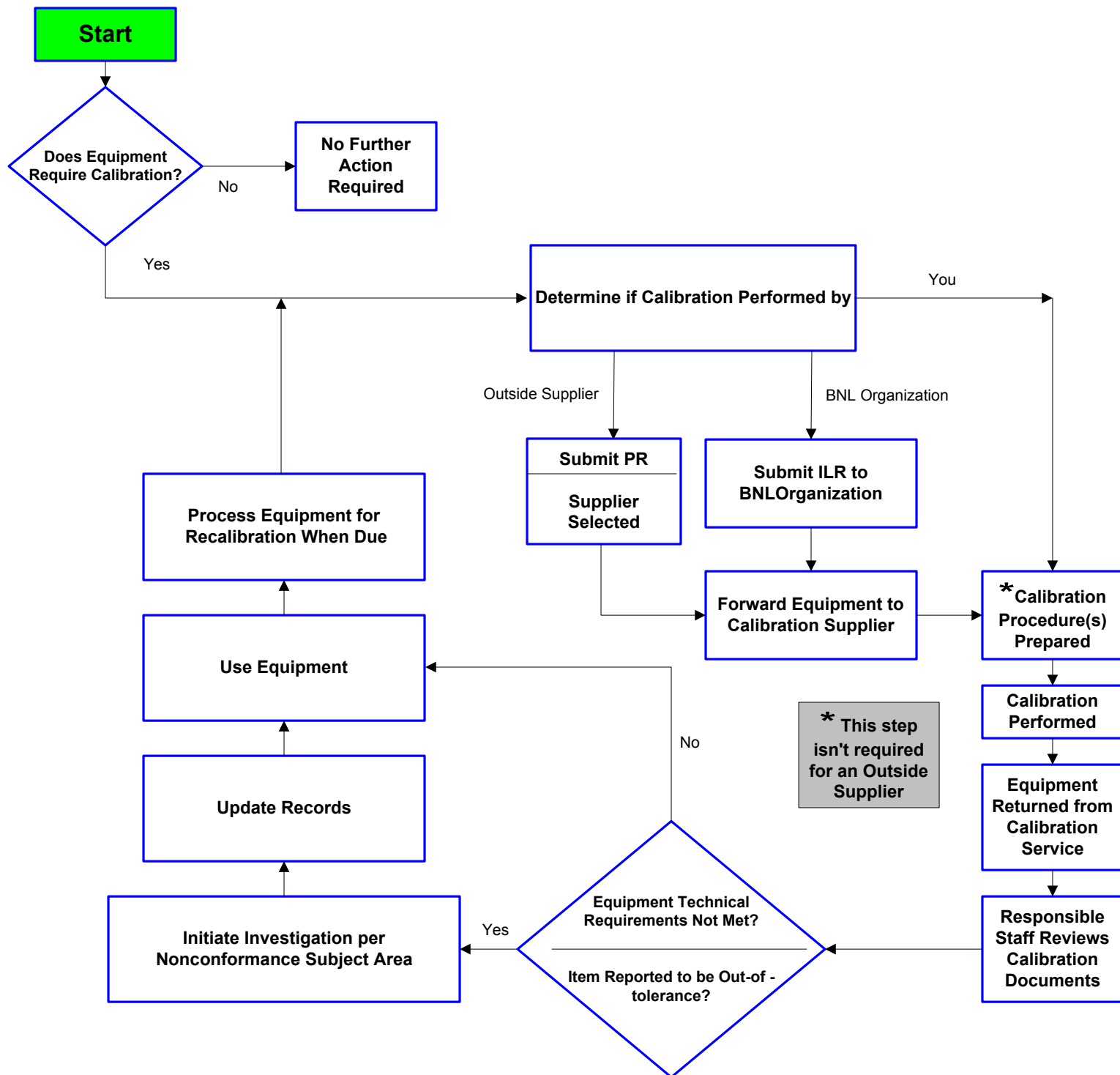
- identification of procedure used to calibrate the balance/micropipette
- description of balance/micropipette:
  - Manufacturer, Model Number, Serial Number
- identification of standards used, with traceability to NIST, and Calibration Due Date
- temperature under which calibration performed
- before and after data taken at prescribed intervals, with Manufacturer's or Contractor's Tolerance (+/-)
- status of balance/micropipette with respect to Manufacturer's Tolerance or Contractor's Tolerance (Pass/Fail)
- identify restrictions
- date of calibration
- next due date of calibration
- signature (initials) of person performing the calibration

This certification form must be provided to the Technical Representative or designated point of contact within 48 hours of completing the service. Detailed support data, e.g. calibration certificates of standards and/or equipment used for calibration of the balances/micropipettes shall remain in the Contractor's file for a minimum of five years and shall be available for review by BNL.

**Equipment Labeling:** The Contractor shall affix a label, approved by BNL's Office of Quality Programs and Services, to each calibrated balance/micropipette, which indicates

- the Contractor's name
- identification of equipment
- date of calibration
- next due date of calibration
- signature (initials) of person performing the calibration

# CALIBRATION FLOWCHART





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*Subject Area: **Calibration***

## **Optimizing Calibration Intervals**

Effective Date: **May 2003**

Point of Contact: [Quality Programs & Services Office](#)

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Optimization is a decision-making process that promotes efficiency of operation and cost-effectiveness. The decision to calibrate equipment at a given interval is contingent upon the use of the equipment, the desired accuracy of data, the basis for protecting research, and the client and technical requirements.

Results of calibration should be trended, and corrective actions are determined for any problems with equipment reliability.

If the calibration interval is consistently in tolerance for six to eight intervals, it is recommended that you extend the interval 50% to 100% of the current interval and monitor the results. The decision to increase the interval should be monitored until it is optimized.

If the equipment is out-of-tolerance for three out of five intervals, or if it is out-of-tolerance for an annual calibration for two consecutive intervals, it is recommended that you

- shorten the interval;
- broaden the tolerance;
- limit the calibration; and
- replace the M&TE.

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## QUALITY CONTROL SELF ADHESIVE LABELS

Label Size:  $\frac{5}{8}$ " X  $1\frac{1}{4}$ "

Ink Color: See Specific Label

BNL Stock No.: See Specific Label

Unit of Issue: Sheet (20 labels)

\*\*\*\*\*

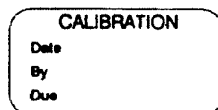
Stock No.: S-33838, Ink Color: Green



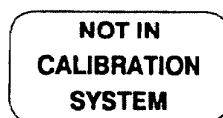
Stock No.: S-33840, Ink Color: Red



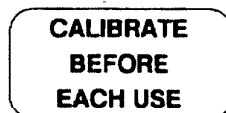
Stock No.: S-33842, Ink Color: Blue



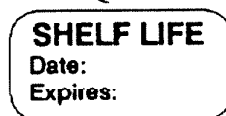
Stock No.: S-33844, Ink Color: Red



Stock No.: S-33846, Ink Color: Red



Stock No.: S-33858, Ink Color: Black



Stock No.: S-33848, Ink Color: Green



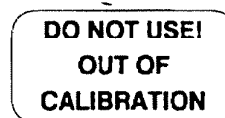
Stock No.: S-33850, Ink Color: Red



Stock No.: S-33852, Ink Color: Blue



Stock No.: S-33854, Ink Color: Red



Stock No.: S-33856, Ink Color: Blue



## QUALITY CONTROL TAGS

Tag Size: 2 1/8" X 4 1/4"  
 Tag Color: See Specific Card  
 Unit of Issue: Each

BNL Stock No.: See Specific Tag  
 Ink Color: Black  
 Fastener: See below

\*\*\*\*\*

Stock #: S-05676,  
 Color: Green

Stock #: S-05678  
 Color: Red

Stock #: S-05680  
 Color: Lt. Green

<b>ACCEPTED</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Remarks _____	
Inspector _____	Date _____

<b>REJECTED</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Remarks _____	
Inspector _____	Date _____

<b>REPAIRABLE or REWORK</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Remarks _____	
Inspector _____	Date _____

Stock #: S-05682  
 Color: Yellow

Stock #: S-05684  
 Color: Blue

Stock #: S-05686  
 Color: Manilla

<b>HOLD - DO NOT USE!</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Remarks _____	
Inspector _____	Date _____

<b>TESTED</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Remarks _____	
Inspector _____	Date _____

<b>RETURN TO VENDOR</b>	
Vendor _____	Job No. _____
Description _____	Quantity _____
Part Number _____	
Serial Number _____	
Remarks _____	
Inspector _____	Date _____

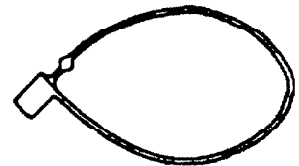
Stock #: S-05688  
 Color: White


Stock #: S-05690  
 Color: Red

BNL Stock # S-05700  
 Security Fasteners:

<b>SHELF LIFE</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Shelf Life _____	Expiration Date _____
When Stored At _____	
Inspector _____	Date _____

<b>SCRAP</b>	
Part Name _____	Job No. _____
Part Number _____	Quantity _____
Serial Number _____	
Remarks _____	
Inspector _____	Date _____





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Subject Area: **Calibration**

### Recommended Calibration Intervals

Effective Date: **May 2003**

Point of Contact: [Quality Programs & Services Office](#)

This exhibit does not contain an all-inclusive list. For equipment not on this list, contact the equipment manufacturer for recommended calibration intervals.

Instrument	Interval, months	Instrument	Interval, months
Amplifiers	6-12	Multimeter	12
Anemometer, Set	12	Multimeter, Digital	6-12
Attenuator, Set	12	Oscillator, Test	12
Balances (Beam, Torsion)	1-12	Oscilloscope	6-12
Barometers	12	Oxygen Indicator	6
Bar, Sine	12	Photo Tachometer	12
Bridges	12	Plate, Sine Angle	12
Calibrator, Pneumatic	6	Plug-in (Scope)	12
Caliper (Combination, Dial)	12	Potentiometer	12
Capacitors	12	Power Supplies	6
Controllers, Temperature	6	Pyrometer, Heat-Probe Indicator	6-12
Counter (Frequency, Preset, Stobotac)	12	Pyrometer, Optical	6-12
Dividers, Voltage	12	Radiation Safety Survey Meters	12
Dynamometer	6	Recorder, Volt/Amp	12
Electrometer	12	Recorders (General)	6-12
End Measuring Rod	12	Recorders (Oscillograph)	6-12
End Standards	12	Resistors Decade	6-12
		Resistors (Fixed and	

Flow Meter	12	Resistors (Fixed and Standard)	12
Force Measuring Device (Compression, Tension, Torque)	12	Resistors (Shunt)	24
Gage Blocks	12	Rotameter	12
Gage (Depth, Dial, Height, Pressure, Radius, Vacuum, Wire)	12	Rotary Table	24
Gage, Plug (Multiple or Repeated Applications)	1	Scale, Platform	12
Gage, Plug (Occasional or Exploratory Applications)	6	Squares and Parallels	24
Gage (Thickness, Coating, Flaw Detector)	6	Square (Precision, Steel)	12
Gauss meter	6	Standard Cells	12
Generator (Pulse, Signal, Sine, Time Mark)	12	Surface Plates	12-24
Hardness Checkers	12	Tester, Capacitance	12
Hygrometer	6	Tester, Insulation	12
Hygrothermograph	12	Tester, Tube	12
Indicator, Dial	12	Theodolite	12
Indicator, Temperature	6	Thermometers	24
Inductors	12	Thermometer, Digital	12
Industrial Hygiene Measurement Devices	12	Thread Wires	12-24
Length (Masters, Standard)	12	Timer, General	12
Level, Precision	12	Velometer	12
Manometer	12	Vibration Analyzers, Meters	12
Meter, Electronic/Electrical	6-12	Voltmeter (AC/DC, Digital)	12
Megger	12	Weight, Metric	12-24
Micrometer (Depth, In/Outside, Thread, Tube, V-Anvil)	1-12	Wrench, Torque	6-12
Milliammeter, DC	12	--	--

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## ☐ Balance    ☐ Micropipette Information Form

**Department/Division:**

**Bldg:**

**Technical Rep. or designee:**

**Phone Ext.:**

(Contact this individual for lists, schedule, extensions, repairs)

**Bldg Mgr:**

**Phone Ext.:**

(Contact this individual to coordinate access to building(s))

**Business Admin. Contact:**

**Phone Ext.:**

(Contact this individual for questions regarding billing/payment)

Manufacturer	Model & Serial No. or Unique Id No.	Owner	Location (Bldg/Room No.)	Calibration Frequency	Due Date	Account Number	Comments

## CALIBRATION DATA FORM

Equipment Description \_\_\_\_\_  
Manufacturer \_\_\_\_\_  
Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_ Unique Id. No. \_\_\_\_\_  
Calibration Procedure \_\_\_\_\_  
Calibration Frequency \_\_\_\_\_  
Comments \_\_\_\_\_

Environmental Conditions: ☐ N/A

Temperature \_\_\_\_\_ Pressure \_\_\_\_\_ Relative Humidity \_\_\_\_\_

### Standards and Calibration Equipment Used

<u>Description</u>	<u>Identification No.</u>	<u>Calibration Due Date</u>

<u>Step</u>	<u>Function Tested</u>	<u>Expected +/- Tolerance</u>	<u>Before</u>	<u>After</u>

☐ Accepted    ☐ Rejected    ☐ Limitations


Next Calibration Due Date \_\_\_\_\_

Performed by \_\_\_\_\_ Date \_\_\_\_\_

# CALIBRATION EQUIPMENT INFORMATION FORM

[illegible]





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**Definitions: Calibration**Effective Date: **May 2003**Point of Contact: [Quality Programs & Services Office](#)


Term	Definition
accuracy	The closeness of the agreement between the result of a measurement and the (conventional) true value of the parameter being evaluated.
calibration	The set of operations that establish, under certain specified conditions, the relationship between values indicated by a measuring instrument or system, or values represented by a material measure, and the corresponding known values of a parameter being evaluated.
frequency	The time between successive scheduled calibrations for a given item or equipment.
out-of-tolerance	A condition in which a measured value of a measurement attribute lies outside the documented performance specifications for the attribute or a state in which one or more attributes of an item are not in conformance with documented performance specifications.
standard	A material measure, measuring instrument, or system intended to define, realize, conserve, or reproduce a unit, or one or more known values of a quantity, to transmit them to other measuring instruments by comparison.
technical requirements	A list of the type of equipment, range, accuracy, tolerance, resolution, precision, and reliability to accomplish its intended function.

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**Revision History: Calibration**

 Point of Contact: [Quality Programs & Services Office](#)


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## Revision History of this Subject Area

Date	Description	Management System
May 2003	<p>This subject area was revised to incorporate two improvements:</p> <ol style="list-style-type: none"> <li>1. The subject area did not explicitly refer to the four ESH&amp;Q Risk Levels that are used to implement the Graded Approach. The revision makes specific reference to them and provides instructions for how they are applied.</li> <li>2. To assist the responsible individual in selecting an Off-site Supplier to calibrate equipment, a link to the <a href="#">List of Calibration Laboratories Approved by QPSO</a> was added. If the responsible individual uses a supplier from this list, the requirement to evaluate the supplier is already satisfied.</li> </ol>	Quality Management
March 2001	<p>This subject area was rewritten to clarify roles and responsibilities of staff involved in the three calibration approaches practiced at the Laboratory:</p> <ol style="list-style-type: none"> <li>1) Equipment Calibrated by an Off-Site Supplier;</li> <li>2) Equipment Sent to an On-Site BNL Organization for Calibration; and</li> <li>3) Equipment Calibrated within a Department, Division, Project.</li> </ol> <p>The following sections were deleted: Determining the Need to Calibrate Equipment; Entering Equipment into the Calibration Program; and Handling of Lost, Damaged, or Out-of-Tolerance Equipment.</p> <p>The section Establishing a Calibration Program was revised and renamed Determining if Calibration is Required, the section Calibrating Equipment was revised, and the section Issuing, Using, and Recalling Equipment was renamed to Scheduling Equipment for Recalibration. Four new exhibits (BNL Statement of Work for Calibration of Balances and Micropipettes, BNL Statement of Work for Calibration of Balances</p>	Quality Management

	<p>and Micropipettes Balance-Micropipette Information Form, Quality Control Self-Adhesive Labels, and Quality Control Tags) were added. Three exhibits were deleted (Technical Requirements for Calibration Form; DOE-STD-1054-93; and M&amp;TE Issue Control Form).</p> <p>The Calibration Equipment Information Form was consolidated into one page to facilitate its use.</p> <p>The narrative on how the Graded Approach is used to identify equipment to calibrate was clarified.</p> <p>Guidelines were added to help users address common calibration issues.</p> <p>The Calibration Flowchart was revised to reflect the changes in the subject area.</p>	
March 1999	This information was developed by a team using the process for Standards-Based Management System development. This subject area is a replacement for BNL-2AG-901, "The Calibration and Control of Measuring and Test Equipment," BNL Quality Assurance Manual.	Quality Management

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